



# Education For Economic Renewal

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A summary of proposals by Governor Bruce Babbitt  
to the Arizona Legislature — January, 1983

AS WE DEBATE PUBLIC POLICIES TO STIMULATE ECONOMIC GROWTH AND REGAIN OUR ECONOMIC STRENGTH, we ought to remember that our public schools are a stronger economic weapon than any monetary theory, trade policy, or book on Japanese management. Education generally — the public school in particular — is the most basic source of long term American productivity and economic well-being.

While the quality of public education was important in the past, it will be indispensable to our future. A century ago, most Americans worked on the farm. Productivity required a strong back, and McGuffey's Reader was sufficient education for most. Fifty years ago most Americans worked in assembly line and other industrial jobs that required only basic literacy and some apprentice training. By the end of this century, however, the majority of Americans will be working in information and technology jobs requiring solid quantitative skills and a measure of computer literacy as a condition of employment.

Paradoxically, at the very time high technology accelerates the need for an educated work force, we are drifting into an educational climate of lowered standards and reduced levels of educational achievement. One writer has described our indifference to educational achievement as an act of unilateral economic disarmament.

For example, in the last fifteen years there has been a well documented decline in the learning achievement of our children. Since 1967 the national average scores on the Scholastic Aptitude Test have fallen more than five percent in math and eight percent in verbal from an average of 492 in math and 466 in verbal to 467 in math and 426 in verbal. Our universities are turning out fewer of the scientists and engineers responsible for the technical innovation that now generates most of our economic growth. Widespread problems of literacy permeate our armed forces and disqualify many young adults from the promising technical jobs that make up an increasing part of the national economy. There are many indicators that the American education system is now lagging behind such competitors as Japan, West Germany and the Soviet Union. For example:

In 1980, the United States graduated 58,000 engineers. Japan, with one-half our population, graduated 74,000, while the Soviet Union, with approximately the same population as the United States, reportedly produced 300,000.

Engineers accounted for six percent of the B.S. degrees awarded in the United States in 1980 — but they amounted to 21 percent in Japan, 37 percent in West Germany, and 42 percent in Eastern Europe.

Doctoral degrees conferred in engineering in the United States fell from 3,400 in 1969 to only 2,800 in 1979. Nearly half of those degrees were granted to foreigners, two-thirds of whom are in the country on temporary visas.

Only 34 percent of the country's high schools teach trigonometry; less than a third teach calculus. Only 6 percent of our high school students take even a year of calculus. All Soviet students, on the other hand, take five years of physics, four years of chemistry, and two years of calculus before they graduate from high school. Japanese high school students are required to take four years each of math and science.

While such general comparisons can be misleading, they do tell us unequivocally what most parents, myself included, already suspect — that we have relaxed our standards and that we are not demanding enough of either our children or ourselves as parents.

Educational excellence is not an abstract issue. In Arizona, at least, it directly affects our economic development and the job futures of our children. Arizona has already cast its future

with high technology — computers, micro-electronics, semiconductors and aerospace — and that commitment accelerates each year. If we are to sustain this trend, we must invest more intensively in an entire new generation of human capital and technical skills.

In the last three years we have, with the strong support of the private technology sector, made large investments in our university system to support excellence in biological sciences, physical sciences and engineering. These investments have already enhanced Arizona's competitive position. We must now extend our commitment to excellence throughout our public education system.

The proposals which follow are just a beginning. While they are focused on the basic issue of achievement in mathematics and science, there is no question that similar problems confront us in basic literacy, use of the English language and the entire spectrum of liberal arts.

## **1. HIGHER ADMISSION REQUIREMENTS FOR MATH AND SCIENCE IN OUR STATE UNIVERSITIES.**

The direct approach to raising standards is to make more demands on students, particularly those going to college. One reason that students do not achieve is that we do not require enough of them. For example, Arizona high schools are required to provide, as a minimum for graduation, only one year of math and one year of science. These minimal requirements are also reflected in the admissions requirements of our state universities. These facts strongly suggest that our education system is not making adequate demands. Our children are consuming too many sweets at the very time that the main course of scientific literacy has become a prerequisite for the technical jobs that make up Arizona's future.

It is time to state unequivocally that a taxpayer-supported university education is an opportunity that will require serious and demanding preparation at the high school level. If the universities of our state are willing to set and maintain higher admission standards, their example will inevitably operate to raise standards at the elementary and secondary level.

I am therefore, requesting that the Board of Regents consider a policy that all three Arizona universities require four years of English, three years of mathematics, and two years of science as a condition of admission. I propose that these higher entrance requirements will be implemented prospectively so that students currently in the eighth grade will have a chance to plan their high school curriculum.

In the meantime, we must work to provide the expertise and resources to enable high school districts throughout the state to re-orient their curricula to meet these higher standards. We must also urge teachers and parents to aim high, and to counsel our children that, while the future is bright, it will also be very demanding. We must persuade ourselves and our children that we cannot excel as a society unless we each excel as individuals.

## **2. MATH AND SCIENCE CENTERS AT OUR UNIVERSITIES FOR OUTSTANDING HIGH SCHOOL STUDENTS.**

At the same time that we build a solid math/science base for all of our students, we must also make a stronger effort to provide opportunity for students of exceptional ability. Other states provide many interesting examples which we might

consider: New York City has the Bronx School of Science; Massachusetts has the Boston Latin School; North Carolina has established a single residential high school to attract high achievers from throughout the state; and in Maryland the universities offer special summer programs for high school students in advanced math and science.

In Arizona, we already have several successful examples of advanced summer high school classes sponsored by our universities and community colleges. However, these efforts are small, outreach is limited, and there are not adequate scholarship resources to assure that opportunity is available to economically disadvantaged students. Arizona should begin to emphasize summer math and science with an expanded program which brings together teachers, curriculum, and student counseling in a coordinated and well-publicized program for high achievers.

I have therefore asked all three University presidents to take the initiative for developing special Math and Science Centers at the university level. These Centers will coordinate coursework and counseling, working in cooperation with high school teachers, for outstanding secondary students. It is expected that the Centers will be most active during the summer. But I will also encourage the universities, community colleges and local school boards to experiment with the use of release time programs during the regular school year.

Scholarships should be made available to those who otherwise would not be able to attend. I am therefore asking the Legislature to appropriate the sum of \$50,000 this year to the Board of Regents to provide tuition and living assistance to eligible students.

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As we act to raise curriculum standards across the board and to provide special opportunity for the gifted, we must also confront the impending shortage of math and science teachers. Arizona is already experiencing a shortage of teachers qualified to teach math and science. Of the more than 23,000 secondary teachers currently certified in the state only five percent are specialists in math, .3 percent in general science, .9 percent in chemistry, .3 percent in physics, and .4 percent in physical science. By contrast, 14 percent have a major emphasis in physical education. In 1981, our colleges of education graduated a total of three new math teachers.

The shortage of math and science teachers can be traced partially to high demand and high salaries for scientists in the private sector. A young math teacher can easily double his or her salary by entering the private sector. If the exodus of math and science teachers to private industry continues, we will consume the seed corn that should be set aside to educate the next generation. The shortage of math and science teachers cannot be remedied overnight, but we can take steps to reverse the trend. The four proposals that follow are designed to increase the numbers and effectiveness of classroom science and math teachers.

### **3. A STUDENT LOAN PROGRAM TO ENCOURAGE MORE MATH AND SCIENCE TEACHERS.**

One such incentive is to establish a student loan program that would allow new science and math teachers to pay back their indebtedness through service in our schools. The program

would allow a student being trained as a math or science teacher to finance his or her college education with public loan aid accompanied by an understanding that, upon graduation, one year of the loan total would be forgiven for each year of teaching in Arizona public schools. Teachers from other disciplines seeking recertification in math or science would also be eligible.

While a loan forgiveness program is certainly not a complete answer to the salary disparity that is drawing science students from teaching, it will at least provide an inducement to more graduates to begin their career in teaching. I suspect that a fair proportion of new teachers may find the intangible rewards of teaching and inspiring students a good reason to remain in the profession.

For these reasons, I am asking the Legislature to appropriate \$100,000 for a special student loan program for math and science teachers to be administered by the Board of Regents.

### **4. SUMMER SCIENCE AND MATH INSTITUTES FOR TEACHERS.**

While we need to encourage more people to enter teaching in these vital fields, we must also help current teachers in their efforts to be as effective as possible. I am therefore recommending that the Legislature appropriate \$250,000 for establishing special Math and Science Institutes at our Universities to assist elementary and secondary teachers in updating their skills and in keeping abreast of the most recent advances in their fields.

We already have evidence that such efforts can work. In 1978, the Arizona State University Mathematics Department sponsored a summer institute for teachers from around the state, who worked with professors to develop workshops that were then presented across Arizona. A follow-up study of CAT scores found that students taught by teachers who had attended the workshops scored significantly higher, on average, than those taught by teachers who had not.

### **5. COMPUTER LITERACY AS A REQUIREMENT FOR STATE TEACHER CERTIFICATION.**

Computers are the new reality of our educational environment. When our generation attended high school, the word was unknown; IBM was still a typewriter company, and UNIVAC was experimenting with a room full of vacuum tubes in Pennsylvania. Today computer literacy is a commonplace job requirement. By the year 1990, 90 million Americans will be working with computers on the job. Here in Arizona, with our strong technical base, computers will be even more important. We cannot let our children leave school without the ABC's of computer usage.

Many states are providing children hands-on computer experience. Texas is currently considering a policy to require computer instruction in seventh and eighth grade. Florida and Iowa have mandated competency in computers from public school children and other states, including Arizona, have widespread programs even in the absence of legal requirements. As we move toward computer literacy requirements, however, we must ensure that teachers are equipped to instruct our children in the use of computers. If students are to fully understand the world of the computer, they must have teachers who understand it, too.

I am therefore calling on the State Board of Education to include basic computer knowledge as a requirement for state teacher certification. I will also encourage school districts to make provisions for existing teachers to be trained in this critical skill.

## **6. COMPENSATION FOR SCIENCE AND MATH TEACHERS.**

Across the nation, a shortage of qualified math and science teachers is aggravated by the simple fact that good teachers with credentials can cross the street to a technology industry and earn twice as much money. In our Universities, this market reality is recognized and various types of differential pay scales are routinely used; medical school salaries are a common example. The aversion of the teaching profession to differential salaries is widespread and well known. Nonetheless, we cannot simply ignore the issue and continue to lose our best science and mathematics teachers by inaction.

During the past four years, the Houston Independent School District has responded to the crisis by augmenting the salaries of teachers most in demand. Additional stipends of up to \$2,000 are provided to teachers who specialize in shortage areas: science, special education, mathematics, and bilingual education. We must be equally creative in our response to the problem of teacher shortage here in Arizona. I am therefore requesting the Legislature to include \$100,000 in the Department of Education budget to finance pilot projects in selected districts for increasing teacher compensation in math and science.

## **7. EXTENDING THE SCHOOL YEAR.**

Educating the student has been compared to taking a photograph: the final product depends on both the intensity of light and the length of exposure. In Arizona, the statutory length of exposure, 175 days per year, is too short. Twenty-eight states have a school year of 180 days. The length of the school year in Japan is 210 days, in West Germany 240 days, and in Russia 204 days. I am therefore requesting that the Legislature extend the school year by another five day week to a total of 180 days beginning in 1984. It may well be that both the academic day and the academic year could be even longer. This proposal is a beginning.

## **8. CHALLENGE GRANTS FOR FACULTY DEVELOPMENT.**

In recent years the legislature has appropriated increasing sums for development of science programs at our universities. Several such efforts have been aided by generous grants from private sector companies including Sperry, Honeywell and Motorola. The concept of private sector involvement should be encouraged in every possible way, including the endowment of faculty chairs in science and engineering at our three universities.

I am asking the Legislature to establish a matching grant endowed science professorship program that would function as follows: any individual or corporation making a grant of \$300,000 to endow a professorship in any science, mathematics or engineering faculty at an Arizona University would receive a continuing commitment from the Arizona Legislature to match the annual endowment for the chair. In Virginia, a similar endowment income match program has attracted over \$9 million in private contributions since it was established in 1966. There is no reason not to expect equally good results in Arizona.

The proposals that I have made will not require large sums of money. Several of them emphasize private sector assistance. In other cases, it may be possible to redirect existing revenues to these priorities. But if we are to remedy deficiencies and strengthen our commitment to Arizona's technology future, it will also be necessary to direct some new revenues to these reforms. Fortunately, we have enacted in Arizona a forward-looking Urban Lands Act to rationally manage the development and sale of our public lands set aside for support of education. New increments of revenue from the school trust funds could be dedicated to the funding of these priority science and math initiatives.

Twenty-five years ago, prompted by the first Sputnik, Americans took successful action to revitalize education. Today, the challenge is somewhat different. It is Japan that is launching micro-chips and computer products into a global economic orbit. It is again time to accept the challenge of educational excellence. We must guarantee quality in our schools. We must attract quality teachers, and ensure their performance and effectiveness in the classroom. And we, as parents, must renew our direct commitment to helping our children. These proposals are only the beginning. I am certain that many other good ideas will come from parents, educators and members of the Legislature.